A Strategic Approach to Anemia Control

MOST
The USAID Micronutrient Program

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Philip Harvey

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Table of Contents

List of Acronyms

AIDS	Acquired immune deficiency syndrome
ANC	Antenatal care
BCC	Behavior change communication
GAIN	Global Alliance for Improved Nutrition
CIDA	Canadian International Development Agency
HIV	Human immune deficiency virus
IDA	Iron deficiency anemia
IEC	Information, education and communication
IFA	Iron and folic acid
IMCI	Integrated management of childhood illnesses
INACG	International Nutritional Anemia Consultative Group
IPT	Intermittent preventive treatment
ITM	Insecticide-treated materials
MOH	Ministry of Health
MOST	USAID Micronutrient Program
NGO	Non-governmental organization
PZQ	Praziquantel
RBM	Roll Back Malaria Program
USAID	United States Agency for International Development
WHO	World Health Organization

Executive Summary

Anemia is a huge public health and nutrition problem with serious consequences. Anemia is particularly common in pregnant women and young children in developing countries. Anemia increases maternal and perinatal mortality, has adverse effects on cognitive development, and reduces physical capacity and work productivity in adults. Despite its significance to public health and nutrition, anemia often has been a low priority on the agendas of ministries of health and of donors. Few countries have been able to reduce the anemia problem on a large scale. This brief describes a strategic approach to reducing anemia that is based on addressing comprehensively its major preventable causes in the target population. It draws on the experiences that MOST, the USAID Micronutrient Program, has had in supporting the ministries of health in the Democratic Republic of the Congo, Ghana, Uganda, and Nicaragua in developing approaches to address anemia.

Despite its significance to public health and nutrition, anemia often has been a low priority on the agendas of ministries of health and of donors. Few countries have been able to reduce the anemia problem on a large scale.

Anemia has multiple causes—including the inadequate intake of iron and other nutrients, poor absorption of iron, malaria, parasitic worms, infections, and genetic disorders. Over recent years, awareness has grown that success in reducing anemia will require coordinated, and even integrated, interventions that address its major preventable causes in populations, i.e., that reducing anemia is about more than food and nutrition. Such an approach requires collaboration across units within ministries, even across sectors, and there is limited programmatic experience of such collaboration.

An anemia control program framework is presented; it starts with high-level advocacy and the creation of an anemia task force. The anemia task force guides a situational analysis that compiles what is known of anemia prevalence and causes, related policies and programs, the economic context of anemia, and the political commitment to address it. Finally this analysis assesses the capacity of institutions that may become involved in program implementation. The information from the situational analysis is used in writing a strategy to guide the coordinated implementation of selected interventions. This strategy will include increasing iron and folate intakes, and where necessary, controlling malaria and parasitic worms. Each of these interventions is described in detail in this brief. Ministries of health can use this framework to design a well-coordinated anemia strategy with the goal of decreasing anemia prevalence.

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Successful implementation of the anemia strategy must be built upon a foundation of four key elements:

- **Effective advocacy with policy makers and community leaders**. To raise the profile of anemia as a significant public health problem, such advocacy is the critical first step in building the political will and accessing the resources to sustain any action.
- **Increasing the overall quality and coverage of health care services**. Motivating staff, strengthening logistics, and improving training and supervision. In many situations, community-based distribution mechanisms will be necessary to extend the reach of health services.
- **Enhancing communication materials.** These materials are needed both to assist health workers in counseling clients and to aid clients in complying with the advice they receive.
- **Collecting and using information about program implementation** to strengthen the management and increase the quality of service provided.

Introduction

Anemia is a huge public health and nutrition problem in developing countries. The World Health Organization (WHO) estimates that anemia affects between one-quarter to one-third of the world's population or up to 2 billion people. Iron deficiency affects many more people. Most of the anemic population lives in developing countries, where high anemia prevalence is seen, particularly in pregnant women, young children, female adolescents, and women of childbearing age.

Overall, anemia contributes to about 20 percent of maternal and perinatal deaths in developing countries. A recent WHO World Health Report noted that the risks of both maternal and perinatal mortality were reduced by 25 percent and 28 percent, respectively, for each gram increase in hemoglobin level between 50 and 120 g/L. This is contrary to the previous generally accepted understanding that only severe anemia resulted in death. This finding is very important because the numbers of women and children with mild and moderate anemia are vastly greater than the number with severe anemia. It follows then that the great majority of anemia-related maternal and perinatal deaths are due to mild and moderate anemia rather than severe anemia.

Overall, anemia contributes to about 20 percent of maternal and perinatal deaths in developing countries. A recent WHO World Health Report noted that the risks of both maternal and perinatal mortality were reduced by 25 percent and 28 percent, respectively, for each gram increase in hemoglobin level between 50 and 120 g/L.

Anemia's other serious negative consequences include poor pregnancy outcomes such as low birth weight and premature birth. Anemia also has adverse implications for social and economic development. There is now strong evidence that anemia can reduce cognitive development and limit a child's learning in schools. This will lower the effectiveness of investments in education. Anemia's role in reducing physical capacity and work productivity in adults has been long established.

Nevertheless, anemia continues to have a relatively low priority in health policies and programs, compared to other nutrition-related health problems with more obvious life-threatening implications. Difficulties are posed by anemia's multiple causes and by the still-limited programmatic experience in and insufficient evidence on effective intervention approaches and best practices to control anemia. These are major constraints for policy formulation and program development. A better understanding of the etiology or causes of anemia and the identification of critical issues related to effective anemia program design and implementation are key to developing more successful actions. Recent progress in understanding the nature of the problem and the achievements and limitations of existing programs provides a firm basis for designing effective strategies and interventions.

MOST, the USAID Micronutrient Program, has supported ministries of health in the Democratic Republic of the Congo, Ghana, Uganda, and Nicaragua to develop approaches to address anemia. This brief describes the MOST Project's experiences together with the options now available for addressing anemia in developing countries. A strategic approach to reducing anemia is presented that is based on addressing comprehensively its major preventable causes in the target population.

Basic Information for Developing an Anemia Control Program

What is anemia?

Anemia occurs when there is an inadequate number of red blood cells or an inadequate amount of hemoglobin for the body to function properly. Hemoglobin is a protein in red blood cells that carries oxygen to the brain, muscular system, immune system, and other parts of the body. Without adequate oxygen, the physical and mental capacities of individuals are reduced.

What are the causes of anemia?

Anemia has many causes. The most common are the following:

- **Inadequate intake of iron and other nutrients,** resulting largely from consuming too little iron in a form that is poorly absorbed. Other nutrient deficiencies that contribute to anemia include vitamins A and C, folate, riboflavin, and B12.
- **Poor absorption of iron**, because dietary components such as phytates in cereal foods bind with the little iron present in plant foods making much of it unavailable for absorption. As a result, iron taken into the body cannot be readily absorbed and used.
- **Malaria**, particularly in young children and pregnant women.
- **Parasitic worms** (e.g., hookworm) and other parasites (schistosomiasis).
- **Infections,** both chronic and systemic (e.g., HIV/AIDS).
- **Genetic disorders** such as hemoglobinopathies and sickle cell trait.

The relative contributions of these causes of anemia vary in different countries. To reduce anemia prevalence in a population, it is important to select interventions that address the primary causes in that population, as listed above.

Anemia occurs when there is an inadequate number of red blood cells or an inadequate amount of hemoglobin for the body to function properly. Hemoglobin is a protein in red blood cells that carries oxygen to the brain, muscular system, immune system, and other parts of the body.

What are the consequences of anemia?

Strong evidence links anemia to health and development problems.

- Overall, about 20 percent of maternal and perinatal mortality in developing countries can be attributed to anemia (World Health Report, 2002[1]). Recent work has shown that most of this impact is in the mild and moderate grades of anemia, rather than being limited to severe anemia.[2]
- Anemia in pregnant women results in lower birthweight babies who have a higher risk of death.
- Iron deficiency with or without anemia reduces work productivity in adults and limits cognitive development in children,[3] thus limiting their achievement in school and ultimately reducing investment benefits in education.

When is anemia a public health problem?

The following WHO-proposed hemoglobin cutoffs for defining anemia in people living at sea level are widely used:

Age group	Hemoglobin level (g/L)
6–59 months	110
5–11 years	115
12–14 years	120
Non-pregnant women	120
Pregnant women	110
Adult males	130

WHO has also proposed a classification of anemia's public health significance in populations based on the prevalence estimated from hemoglobin levels as follows:

Category of public health significance	Prevalence of anemia
Severe	> or = 40%
Moderate	20-39%
Mild	5.0 – 19.9%
Normal	< 5.0%

Estimated regional prevalence rates in pregnant women are as high as 75 percent in Southeast Asia, 55 percent in the Eastern Mediterranean region, 50 percent in Africa, and 40 percent in the Western Pacific region and in Latin American and the Caribbean. In children aged 6–59 months, the rates are about 65 percent in Southeast Asia, 45 percent in the Eastern Mediterranean region and Africa, and 20 percent in the Eastern Pacific and the Latin American and Caribbean regions. Countries with > 10 percent anemia prevalence in one or more of the vulnerable groups should consider anemia as a significant public health problem requiring priority attention.

How are the target groups for an anemia control program determined?

Anemia is so common in developing countries that difficult choices are required to determine the appropriate allocation of scarce resources. Target groups for anemia control could be determined by considering:

- The strength of evidence for associations between anemia and its consequences (maternal and perinatal mortality, poor pregnancy outcome, impaired cognitive development and learning performance in children, and reduced physical capacity and work productivity in adults). These need to be considered separately in different demographic groups.
- An intervention's likely effectiveness and costs.
- An intervention's feasibility in a particular country.

In some populations almost every group is affected adversely by anemia, but almost always priorities will need to be established. The most common priority target groups are, by rank, as follows:

1. Pregnant women
2. Young children 6–24 months of age
3. Female adolescents, eventually as part of a school-aged children approach
4. Women of childbearing age, mainly to ensure that women have the best possible iron status **before** they become pregnant

In some populations almost every group is affected adversely by anemia, but almost always priorities will need to be established.

What interventions should be selected?

A central principle of the MOST approach to develop anemia reduction strategies is that the interventions should be linked to the primary causes of anemia in a population or population group. This statement may sound so obvious as to be almost trivial, but it is often neglected. In particular, uncertainty over iron deficiency's contribution to overall anemia is common and, reflecting this, the terms "anemia" and "iron deficiency anemia" (IDA) have often been used interchangeably. The lack of clarity in these terms has been a barrier to developing programs with measurable impacts. For example, iron supplementation programs will not reduce anemia caused primarily by malaria.

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Unfortunately, it is difficult to assess the relative contributions of different etiologic factors or causes leading to anemia, even in carefully controlled research studies. A practical approach to this information gap is to base planning on the common assumption that 50 percent of anemia is caused by iron deficiency. Where malaria and/or parasitic worms are recognized as public health problems, they are also likely to be important causes of anemia.

Anemia has often been positioned as the responsibility of nutrition units in the Ministry of Health and, in some cases, this has been a barrier to developing a comprehensive approach to anemia as a health problem rather than using a more limited approach to anemia as a nutrition problem. Usually, developing interventions that target all of anemia's major preventable causes rather than restricting interventions to only those that address inadequate iron intake will generate more political support. Coordinating the interventions that address anemia's major causes will result in the most effective outcomes in terms of reducing anemia prevalence. However, coordination of interventions is a substantial challenge in most countries.

Developing a Country Strategy and Program

An Anemia Control Program Model

Figure 1, on the next page, illustrates the model that MOST found useful in helping ministries of health to develop anemia control program strategies. The program components are as follows:

1 Conduct high-level advocacy with key policymakers and administrators in government ministries, donors, universities, and the private sector who have a stake in reducing anemia. A key outcome will be national-level political commitment that will make the anemia program intrinsically more stable.

2 Facilitate the creation of an anemia task force, a core group of stakeholders that is responsible for overseeing the process of developing the strategy and then implementing a national anemia program. Obtaining the genuine collaboration of leaders in reproductive health, malaria, nutrition, parasite control, and education may be the most important challenge in implementing integrated anemia programs.

3 Support a situational analysis that includes an assessment of the anemia problem (prevalence and distribution), current policies and programs, institutional resources available, and the existing capacity to implement interventions. Identify and engage appropriate stakeholders in the situational analysis to develop program ownership.

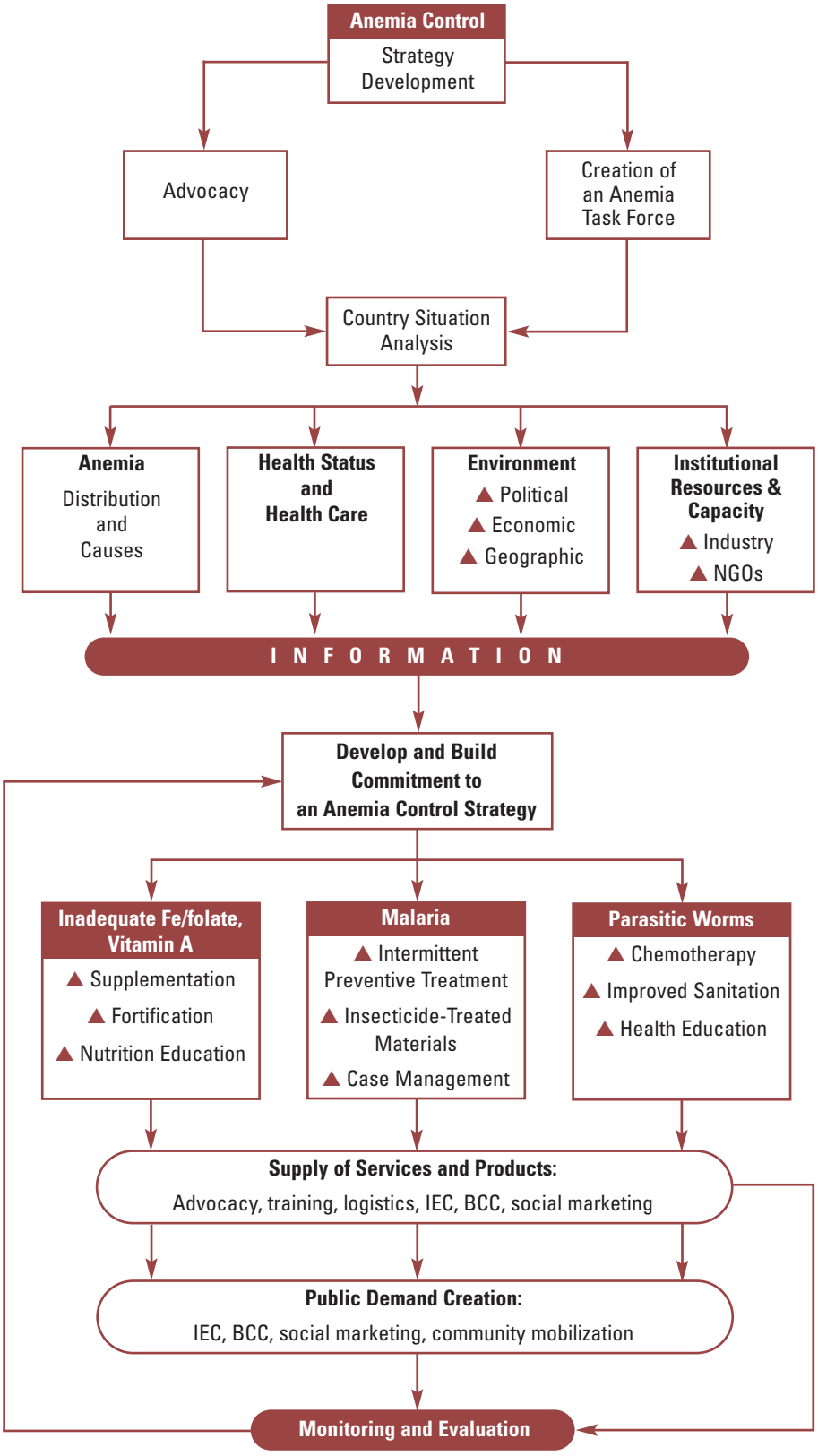
A situational analysis should:

- Establish what is known about the causes of anemia (i.e., diet, malaria, helminthes, inherited traits).
- Describe the health status and also the policies and programs related to these causes and how well they are conceived and managed.
- Describe the political commitment to and economic context within which anemia programs might be implemented, as these two factors are critically important to program sustainability.
- Assess the resources and capacity of institutions that may become involved in program implementation. There is a broad range of activities that the private sector can become involved in as a partner. For example, small retail outlets could receive a supply of treatments for

Basic Assumptions Underlying Anemia Control Strategy

- Unless otherwise documented, iron deficiency causes about half of all anemia cases in developing countries.
- Wherever malaria and parasitic worms (mostly hookworm) are significant public health problems, they are likely to make an important contribution to anemia prevalence.
- In countries where other micronutrient deficiencies exist, particularly those of vitamins A and C, folate, riboflavin, and B12, these deficiencies may play a defined although not-yet-quantified contribution to anemia in those countries.
- Therefore, anemia's multiple causes call for integrated public health and cross-sectoral strategies, with multiple interventions to address factors in addition to iron deficiency.

Figure 1: Anemia Control Program Model



iron deficiency, malaria, and parasitic worms through improved distribution chains. Non-governmental organizations (NGOs) also have enormous potential, particularly in implementing small-scale initiatives that often act as catalysts to convince governments that it is worthwhile to scale up programs to the national level.

▲ Identify information gaps that could hinder strategy and program development.

Information, education and communication (IEC), behavior change communication (BCC), social marketing, and community mobilization are strategies used to increase correct knowledge, forge positive attitudes, and improve desired practices that lead to better anemia control.

4 **Assist the anemia task force to draft an anemia strategy** through a process that builds ownership of and hence commitment to its successful implementation. In addition to specifying goals and specific time-bound objectives, the strategy should include the mechanisms by which different government and non-government institutions will coordinate efforts in an integrated program.

5 **Update protocols, guidelines, communication materials, and training programs needed to strengthen the separate programs that are strategic components**. In sub-Saharan Africa, likely program components will be interventions to:

1) **increase iron and folate intake,**
2) **control malaria,** and
3) **control parasitic worms**.

(Each intervention is described below in more detail.)

6 **Supply**: The program components involve delivery of services and, in many cases, of products. The supply of these services and products requires:

a) Advocacy at all levels to ensure adequate political and financial support for the products and services

b) Training of health personnel who will deliver the services and products

c) Logistics to ensure that the products are available in sufficient quantities where and when they are needed

d) Adequate communication and social marketing support to facilitate delivery of the services and products. It is prudent policy to begin implementation in a limited area to resolve operational supply issues before scaling up to national implementation.

7 **Increase demand:** Once the provision of quality anemia control services and products are in place and ensured, public demand must be created. Information, education and communication (IEC), behavior change communication (BCC), social marketing, and community mobilization are strategies used to increase correct knowledge, forge positive attitudes, and improve desired practices that lead to better anemia control.

8 **Develop a monitoring and evaluation system** that provides information needed for efficient program coordination and management and ensures that program effectiveness is assessed in a timely manner.

Program Components

The three major program components are:

1. Increasing iron intake
2. Malaria control
3. Reducing parasitic worm loads

Increasing Iron and Folate Intake

Inadequate consumption of absorbable iron and folate are the major causes of anemia worldwide. Supplementation and food-based approaches are basic to increasing iron and folate intake. The food-based approach includes fortification and interventions to improve the overall diet.

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Supplementation

Background: Supplementation with iron and folate, at a minimum, targeted to pre-selected priority groups is required almost universally in developing countries as a key component of an anemia control program (see figure 2). Virtually all pregnant women in developing countries require substantially more iron than is available from their diet to meet their nutritional needs. Daily iron supplements, usually together with folic acid, are recommended for all pregnant women, so there is no need to screen women individually for anemia to determine whether or not to give them supplements.

Policies describing IFA supplementation are almost always an integral component of antenatal/postnatal care services, but in many developing countries pregnant women do not access these services or do not have adequate access to the services to reduce anemia prevalence; they do not attend antenatal care clinics early or frequently enough. Understanding and then addressing the determinants of these behaviors is essential to enhancing anemia services for pregnant women (see box 2). Even for women who attend antenatal care services regularly, it is important to address issues that affect their compliance with IFA supplements.

Implementation: Evidence is now available from effective large-scale supplementation programs in Indonesia and Thailand.[4] For many years such evidence was lacking, but this was largely because of either weak program implementation or because the programs were being implemented in populations where iron/folate deficiency was not the sole cause of anemia. Examples of common "system failures" include: inadequate supply of iron/folate tablets and other drugs; inadequate supervision; poor training and motivation of health workers; and

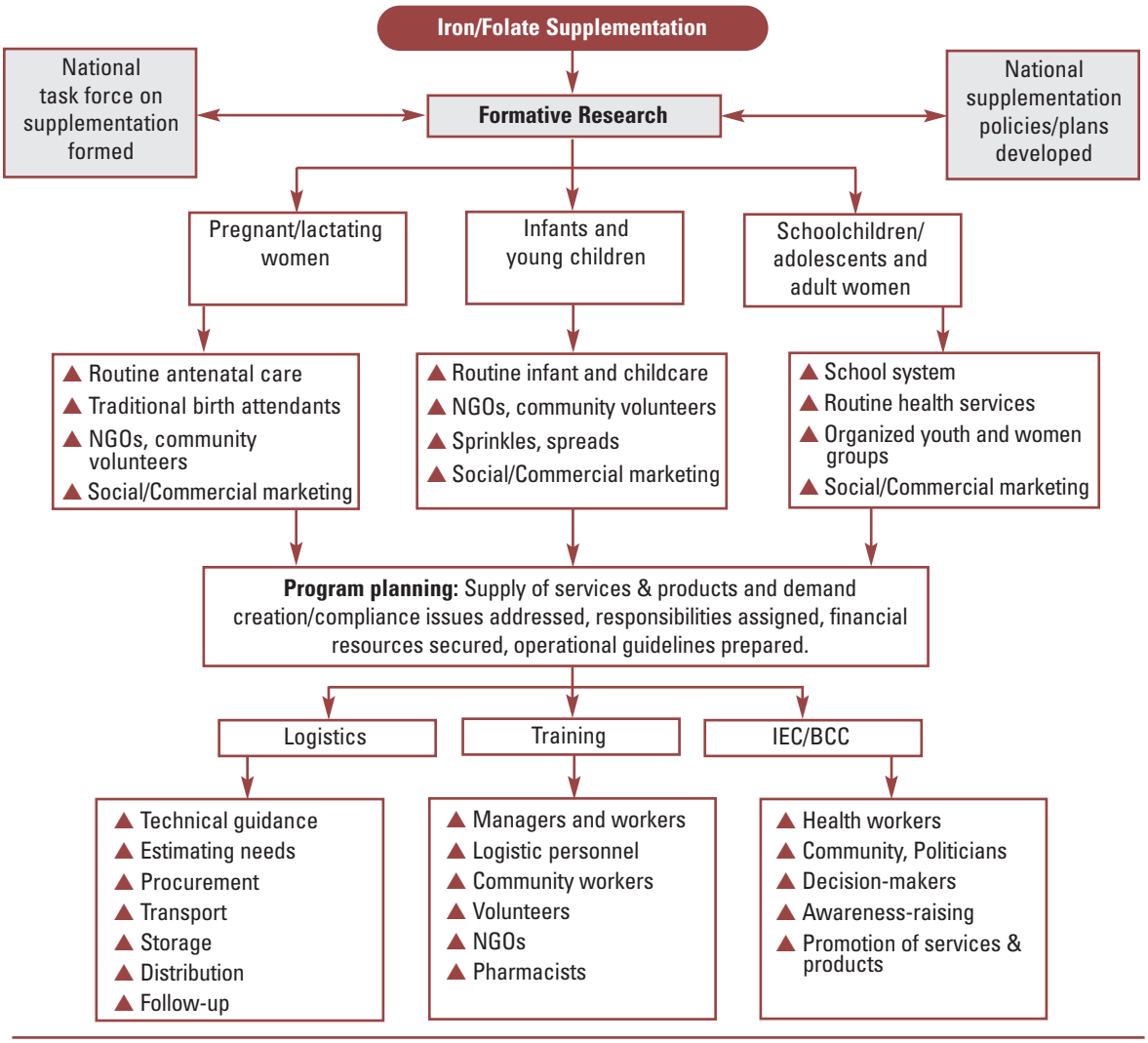
Is it safe to give iron supplementation to clients with anemia in areas where malaria is common?

Yes, it is. Oral iron supplementation is the most effective and commonly used approach to treat anemia resulting from iron deficiency. Yet in areas where malaria is common, some argue that using iron supplements is not a good idea because it will increase the risk of malarial infections. These people argue that it is better not to treat the anemia.

To arrive at a more definitive answer, an analysis of 13 research studies addressing this question was conducted. The analysis provided a clear conclusion: **in malaria-endemic regions, iron supplementation's known benefits outweigh the small risk of adverse effects that malaria causes**. The practical implication is that iron supplementation should continue to be recommended in malaria-endemic areas where iron deficiency anemia is common.

An INACG Consensus Statement on this issue provides a summary of the methods, results and conclusions of the meta-analysis. It is available at: http://www.ilsi.org/malaria.pdf.

Figure 2: Iron/Folate Supplement Program Framework



lack of appropriate counseling on supplementation's side-effects, provision of memory aides, and follow-up to enhance compliance.

Given the need for frequent distribution of supplements to be consumed either daily or intermittently, iron/folate supplementation is generally not amenable to a campaign-style approach. Rather, supplementation should become an integral component of routine health services and/or make use of complementary or alternative distribution channels (e.g., traditional birth attendants, community health volunteers, family planning programs, NGOs, community workers) and social/commercial marketing options (e.g., local pharmacies).

Supplementation for infants and young children (6-24 months) is efficient, but to our knowledge, has never been scaled up to become an effective program in a large population. Two experimental products hold great potential to address anemia in young children: sprinkles and spreads. Sprinkles, as the name implies, are sprinkled onto prepared foods. They are packaged in small single-serve

Supplementation Issues Relevant To Specific Target Groups

Pregnant women. Supplementation for pregnant women should be an integral component of strengthened antenatal care. Expected coverage goals for iron/folate supplementation for pregnant women may not exceed the coverage of antenatal care. Unless this coverage can be increased, expanded supplementation coverage for pregnant women will have to be achieved through alternative delivery channels, such as traditional birth attendants, community health volunteers, family planning programs, NGO community workers, and social and commercial marketing.

Infants and young children. Supplementation for infants and children aged 6-24 months should be an integral part of preventive health care; it should be linked to regular infant and child check-ups, immunizations, growth monitoring, and other opportunities for contact with health services targeted to children within the specified age, as well as within the Integrated Management of Childhood Illnesses (IMCI). Best practices with iron/folate supplementation of infants and young children have not been fully established, as experience and evidence of effectiveness is even more limited than for supplementation for pregnant women. Liquid supplements (syrup, drops) seem the best option at present, although little is known about compliance. Distribution of the liquids is more costly because of their weight. Dispersible tablets are a relatively new technology that has been well accepted in several field trials and offer the potential for scaling up. Sprinkles and spreads are recently developed program options with demonstrated efficacy that may soon be available for implementation and possible subsequent scaling up. To the extent allowed by the resources available, infants and young children deserve high priority in view of the exceedingly high anemia prevalence rates and its developmental and learning implications. And addressing anemia in young children may have a further impact among older children.

Schoolchildren and adolescents. Iron supplementation for schoolchildren and adolescents may use delivery strategies in or outside the health system. High coverage of iron supplementation in schoolchildren is more achievable than in non-secluded population groups (pregnant women, infants, children). Large-scale programs are not common, probably because anemia prevalence is often lower in pre-adolescent schoolchildren than in other more vulnerable groups (pregnant women, infants, adolescent girls) and because of the relatively high overall program costs of covering a significant proportion of the large school-aged population. Iron supplementation of schoolchildren is becoming increasingly popular with growing evidence that it benefits cognitive and learning outcomes in schoolchildren and strong evidence that intermittent, less costly programs are effective. Moreover, international donors may be more interested in supporting nutrition programs that will achieve high coverage and have demonstrated effectiveness. A disadvantage is that those adolescents not attending school cannot be reached in this approach. Preventive iron/folate supplementation of female adolescents makes sense for increasing iron and folate stores to reduce the risk of anemia. Folate supplements will reduce the incidence of neural tube defects in future pregnancies only if the supplements are taken daily.

Women of childbearing age. Preventive supplementation for women of childbearing age may be delivered through either health service systems or other channels (e.g., factories, labor, and religious groups). Experience in this area is growing and looks promising. Cost is clearly a key consideration. Intermittent supplementation through places of employment also has major advantages. Furthermore, the health system may not be the most efficient delivery channel, thus alternative delivery channels, including social and commercial marketing, need to be explored.

packets. Spreads combine an energy supplement with micronutrients and thus also help in addressing generalized malnutrition. Both sprinkles and spreads are entirely flexible in terms of the composition of the added micronutrients, i.e., they need not be limited to iron and folate. These "food-based" products bring advantages over traditional supplements as they are not seen as "medicine" and so it is believed that mothers might be more willing to use them as often as needed (i.e., almost daily). Some have termed these technologies "home fortification," but from a program viewpoint, they are relatively expensive and require substantial behavior change among the target group. Thus, they do not have the key advantage of fortification—especially mandatory fortification—it does not require behavior change.

In developed countries, fortifying wheat flour and breakfast cereals has been practiced for many years and some claim that it has resulted in substantial anemia reductions. The fortification approach's major advantage is that it addresses anemia on a population basis without requiring changes in the target group's dietary behavior.

A Food-based Approach: Fortification of Staple Foods

Fortification of processed staple foods or condiments with iron and other nutrients is often considered a good long-term strategy to address inadequate iron intake (see figure 3), although it is widely acknowledged that supplementation is required to meet the iron needs of pregnant women. In developed countries, fortifying wheat flour and breakfast cereals has been practiced for many years and some claim that it has resulted in substantial anemia reductions. The fortification approach's major advantage is that it addresses anemia on a population basis without requiring changes in the target group's dietary behavior.

The Global Alliance for Improved Nutrition (GAIN) plans to provide an impetus to the development of fortification initiatives. Initiated by the Bill & Melinda Gates Foundation, USAID, and the Canadian International Development Agency (CIDA) and backed by United Nations agencies as well as researchers and private sector concerns, GAIN was launched at the United Nations General Assembly Special Session on Children on May 9, 2002. GAIN aims to reduce micronutrient malnutrition through fortification of mostly staple foods that are consumed by poor and deficient populations. GAIN will work through new national fortification alliances, pursuing a public/private partnership approach.

Challenges to the wider use of food fortification in developing countries include:

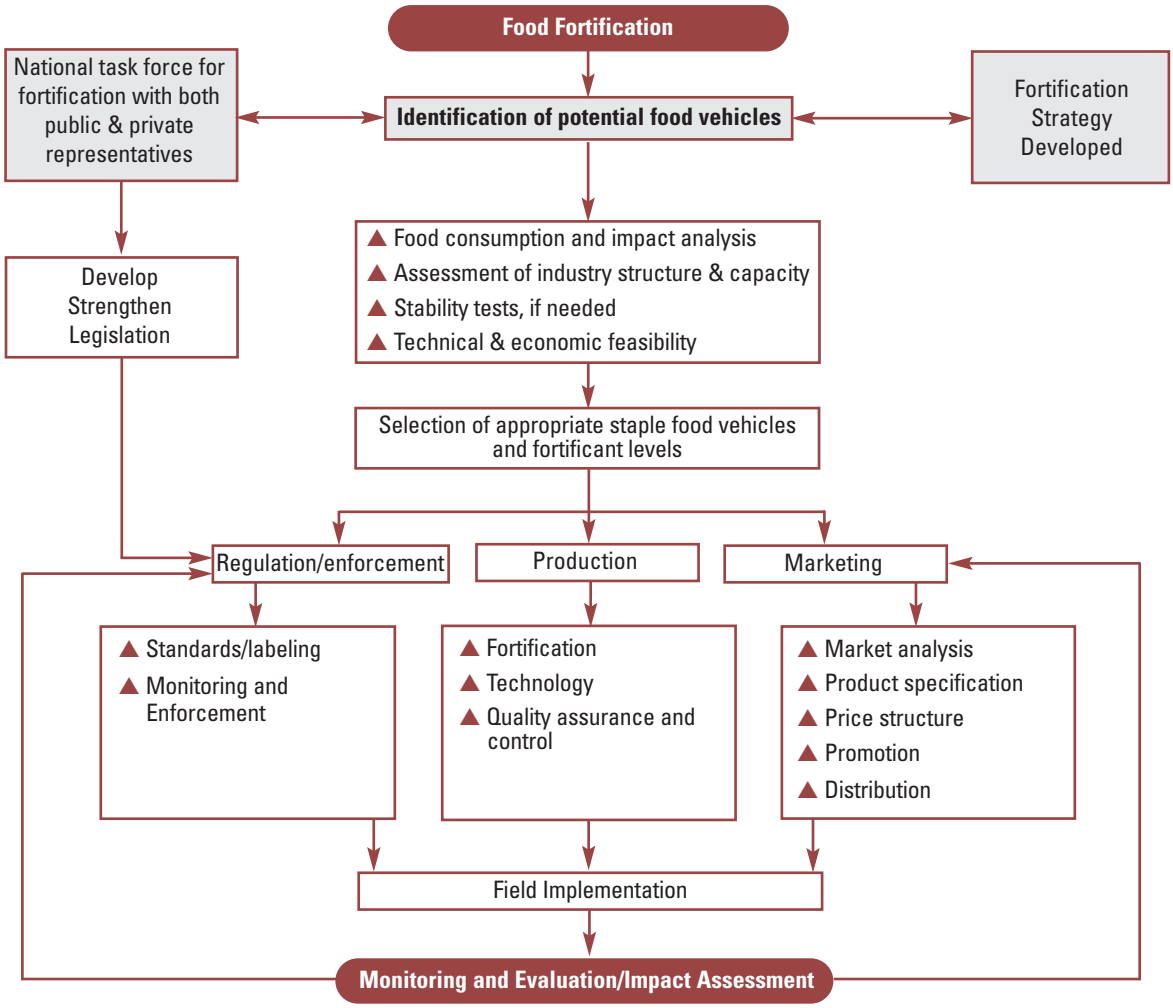
a) The difficulty of identifying an appropriate fortification vehicle in many countries, particularly those with predominantly rural populations that consume little commercially processed foods and many foods that inhibit iron absorption. On the other hand, the urban poor are increasing as a proportion of the population in many countries, and they depend increasingly on processed staples.

b) The choice of fortificant[5] remains a challenge—the bioavailability[6] of forms of elemental iron, (this is the form of iron that reacts least with food), has been questioned. Forms of iron that are more available for absorption are more expensive and tend to react more with foods.

Efforts to address these constraints should include the following:

a) Promoting technical and scientific exchange, e.g., identification of highly bioavailable iron fortificants.

Figure 3: Fortification Program Framework



b) Developing partnerships with other interested groups.

c) Developing instruments to facilitate a systematic assessment of the technical, economic, and political feasibility of fortifying commercially processed food staples commonly found in developing countries such as wheat or corn flour and maize meal.

d) Establishing systematic monitoring and evaluation of iron fortification programs.

Other Food-based Approaches

Interventions that increase diet diversity are appealing because they improve overall food security and the intake of many, not single, micronutrients. However, there is no strong evidence of their effectiveness or even efficacy. This lack of evidence does not necessarily mean that the interventions have no impact but rather that their impacts are extremely difficult to measure. The market price

of foods containing highly bioavailable iron, most of them from animals, is a major constraint to food-based approaches other than fortification. Diet-based strategies hold enormous potential for broadly-based benefits and warrant further investments for their development and rigorous evaluation.

A promising approach is the effort to change dietary practices away from those that result in a reduced absorption of iron from foods consumed (e.g., drinking tea or coffee with meals) and towards those that will increase iron absorption (e.g., fermenting and germinating selected cereals). However, dietary behaviors are usually influenced strongly by cultural and environmental factors and thus are difficult to change in sustainable ways.

Malaria causes anemia both by destroying red blood cells (hemolysis) and also by suppressing the production of new red blood cells. In many countries, particularly in sub-Saharan Africa, malaria is a major cause of anemia in pregnant women and young children.

Malaria Control

Background: Malaria causes anemia both by destroying red blood cells (hemolysis) and also by suppressing the production of new red blood cells. In many countries, particularly in sub-Saharan Africa, malaria is a major cause of anemia in pregnant women and young children. It may be the major cause of *severe* anemia in some areas, especially in young children.

Malaria's impact on anemia is determined by whether malaria transmission is high and year-round (stable) or low and seasonal (epidemic). In areas where malaria is endemic, much of the population develops immunity to the parasite and to some extent, this limits its impact on anemia. Women in their first and second pregnancies and children less than 2 or 3 years of age are at the greatest risk of malarial infection and resulting anemia. For the pregnant women, malarial infections cause anemia that can result in morbidity and mortality and in low birth weight. Malaria infections in the first and second pregnancies also reduce the integrity of the placenta, which results in reduced nutrient transfer to the fetus; this further accentuates anemia's impact on low birth weight, a leading cause of infant mortality.

In areas of low or epidemic malaria transmission and for HIV-infected women, malaria affects all pregnancies, not just the first two. It results in clinical illness, severe diseases, and high risks to both the mother and the fetus.

Interventions: Over the last decade three interventions—intermittent preventive treatment (IPT), insecticide-treated materials (ITM), and case management—have been established as simple and cost-effective strategies to reduce both malaria and anemia in pregnancy. Intermittent therapy involves the administration of full curative treatment doses of an effective anti-malarial drug at predefined time intervals during pregnancy. This is a clinic-based intervention. Treating bednets and other household materials such as curtains has been shown to reduce the vector population and hence reduce exposure to malarial infections not just in households using ITM, but also in other nearby houses that have not used ITM. Together with teaching caregivers how to recognize and treat promptly malaria infection symptoms, this intervention has been implemented successfully through community-based programs. Where malaria control programs are being implemented effectively, options to coordinate them with other anemia control efforts should be explored.

Parasitic worms contribute to iron deficiency and anemia when the iron loss from the body from infections is greater than the amount of iron absorbed from the diet and iron stores are depleted.

Over the last decade, WHO's Roll Back Malaria Program (RBM) has made major strides in strengthening both policy and programs to address malaria. RBM has made special efforts to establish links with the WHO Safe Motherhood program to address malaria in pregnancy and with IMCI for case management of malaria in children. RBM's technical strategies include:

- Prompt access to treatment, especially for young children
- Prevention and control in pregnant women
- Vector control
- Prediction and containment of epidemics

RBM field research has generated compelling evidence for the efficacy of these approaches, particularly in sub-Saharan Africa. The approaches target young children and pregnant women for immediate results in the most vulnerable groups, but also address the larger need for affordable and sustainable approaches to reduce the disease burden at the community and country levels.

Parasitic Worms[7]

Background: Several species of parasitic worms—hookworms and schistosomes in particular—cause blood loss and hence iron loss. Hookworms contribute to anemia in several ways:

- Feeding on blood
- Bleeding caused by damage from their feeding; this is made worse by the effects of anticoagulants that the worms secrete when feeding
- Reducing iron absorption because the worms' feeding damages the intestinal lining where most of the iron is absorbed
- Heavy worm burdens impair appetite
- Lastly, in a cyclical way, the anemia that hookworms contribute to may reduce a person's productivity that, in turn, reduces the person's food quantity and quality. This may happen either directly in farming communities—when a farmer with anemia is less able to produce foodstuffs— or indirectly—when a person with anemia is less able to work and so earns less money to purchase food.

Female schistosome worms lay eggs in blood vessels around the gut or bladder walls, depending on the species. The eggs have sharp spines to help them to penetrate tissue so that they can leave the body in the feces or urine. The holes that are made by these eggs cause bleeding and, as a result, hemoglobin is lost into the gut (in the case of *Schistosoma mansoni* and *S. japonicum*) and into the bladder (in the case of *S. hematobium*).

Parasitic worms contribute to iron deficiency and anemia when the iron loss from the body from infections is greater than the amount of iron absorbed from the diet and iron stores are depleted. The amount of blood a child loses due to parasitic worms depends on the number of worms present, and worm loads usually build up slowly. Parasitic worms generally do not multiply within their host, i.e., each worm is the result of separate infection. Moderate to heavy worm loads typically result from exposure to worms over long periods. This underlies the importance of reducing transmission though sanitation. The heaviest hookworm infections tend to occur in adolescents and adults and thus may make an important contribution to anemia in pregnant women. Hookworm infection in preschool

children may not be a major cause of anemia because the loads are generally not heavy, but including preschool children in de-worming programs early on may delay substantially the onset of anemia, a major advantage.

Treatment: While traditionally, deworming treatment was given to children two years of age and older, there are several good reasons to deworm preschool children, even though this may not reduce anemia measurably in this age group. Studies from India, Kenya, and South Africa have demonstrated that periodic anthelminthic treatment improves growth, physical fitness, appetite, and also enhances a child's cognitive performance. A recent WHO consultation concluded that it is both safe and recommended to deworm children over one year of age[8] in endemic areas. Worm-free children also have better vitamin A status and better immune responses.

Several safe and effective drugs are available to treat parasitic worms. The choice of these drugs depends on their safety record, therapeutic effect, cure rate or efficacy, activity spectrum, experience of local health professionals, staff training, and cost.

Communities usually place a high value on deworming and thus including deworming in a package of preventive services will likely enhance coverage for the entire package of health services. Adding deworming to the package of preventive services for children in the critical second year of life will bring substantial benefits to the children. For example, adding deworming to twice-annual vitamin A distribution rounds and immunization campaigns offers a unique opportunity to reach small children. Reasons for adding deworming to a package of preventive services include the following:

- The drugs are safe, cheap, and easy to administer.
- The drugs have almost no side effects and are effective against most parasitic worms (helminthes).
- Non-medics, such as schoolteachers, can be trained to give the drugs.
- The health benefits are immediate and apparent (e.g., expulsion of round worms).
- There is compelling evidence of substantial health benefits in both the short- and long-term.

Parasitic worm infections in pregnant women are likely to contribute strongly to anemia. WHO recommends a single-dose, oral anthelminthic[9] treatment for hookworm infection for all pregnant and lactating women in areas of high hookworm prevalence.[10] During antenatal contacts in hookworm endemic areas, health workers should give pregnant women a treatment once in the second trimester. If hookworms are highly endemic—i.e., greater than 50 percent prevalence—health workers should give women an additional dose in the third trimester of pregnancy.

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- The benzimidazoles (mebendazole and albendazole) are the most commonly used drugs to treat hookworm and other intestinal worms.
- Albendazole is recommended as a single dose of 400 mg and mebendazole either as a single dose of 500 mg or as 100 mg twice daily for three days. Some are now discouraging the latter because of concern about compliance in completing the full 3-day treatment.

- Praziquantel (PZQ) is recommended for treating schistosomiasis.[11] The recent WHO informal consultation[12] recommended that all infected pregnant and lactating women be offered PZQ treatment either individually or during treatment campaigns. PZQ is also being given to school-aged children with the dose determined on the basis of height.

Advocacy and Behavior Change Communications

As mentioned above, advocacy and BCC interventions should always be part of an integrated approach to anemia control programs. The advocacy and BCC interventions should have five general objectives:

1. Create and raise awareness of anemia's magnitude and its serious implications for the individual and the nation's social and economic development. The intervention should target all levels of society, but particularly policymakers and administrators from all sectors to generate a firm political commitment to address anemia.
2. Improve health care workers' motivation and ability to get actively involved in iron/folate supplementation programs. Enhance their knowledge of the program's importance and the appropriate dosages, and upgrade their skills in counseling and follow-up.
3. Enhance demand and compliance with iron/folate supplements in the population.
4. Promote specific changes in dietary practices that are aimed at reducing the consumption of inhibitors of iron absorption or removing them from the diet (e.g., through soaking and/or fermenting cereals), and increasing the intake of enhancers of iron absorption (e.g., fruit, juices and other sources of vitamin C). Another approach to increasing absorption is to encourage the consumption of tea and coffee at times other than when sources of iron are consumed.
5. To the extent possible, promote increased consumption of food sources of bioavailable iron, including fortified foods.

A recent International Nutritional Anemia Consultative Group (INACG) publication describes in detail the role of communication in a comprehensive anemia control program.[13]

Implementing Priority Interventions

Because financial and human resources are always limited, interventions must be prioritized. Issues to be considered in determining intervention priorities include:

- Existing Ministry of Health priorities and policymakers' interests
- Operational feasibility
- Availability of resources (this may be in the donor's interest)
- Opportunities to build on existing programs and/or capacities of health care and other services. For example, the training programs required to introduce IPT in pregnancy could incorporate revisions and training for the iron folate supplementation program where appropriate
- Evidence of the costs and effectiveness of selected interventions

In many countries, the Ministry of Health places the highest priority on reducing anemia in pregnant women.

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This priority is justified by the strength of evidence linking anemia to maternal mortality and because antenatal care (ANC) services are often well established and accepted and have the potential to provide a range of interventions. ANC services provide the contact point for health workers and pregnant women and thus the ANC anemia component is key to reducing anemia in this target group. Reproductive health or maternal and child health units have the primary responsibility for implementing ANC services, but traditionally there has not been a strong link between reproductive health, malaria control, and nutrition.

It is a very challenging task to coordinate and/or integrate the programs of various health units, perhaps the most challenging task of this anemia control approach.

It is a very challenging task to coordinate and/or integrate the programs of various health units, perhaps the most challenging task of this anemia control approach. The government units that are responsible for the programs that address preventable causes of anemia will need to strengthen logistics, develop communication materials, and provide training and supervision in a collaborative manner. Often, donors and their technical representatives can facilitate this cooperation and these opportunities should not be missed.

Monitoring and Evaluation

Monitoring the process of implementing anemia control interventions, evaluating the program outcomes, and eventually evaluating their long-term impact in reducing anemia should be a defined program component from the outset. Monitoring and evaluation activities may provide a mechanism to assist the various units of the Ministry of Health in coordinating their programs. Certainly cooperation gaps will become quickly apparent through monitoring activities. For example, indicators might include activities in district workplans to coordinate program components, and the extent to which reproductive health, malaria control, and nutrition units have established common or shared budgets or resources or have produced communication and training materials that cover more than one cause of anemia.

Hemoglobin concentration is the accepted anemia indicator in populations, but there are some controversies associated with its interpretation. The cutoff points that WHO has defined (see above) are widely used but are not clearly linked to specific functional outcomes. Because of this some argue that 'mild' anemia is not a public health concern and thus resources should be focussed solely on treating severe anemia. Another controversy concerns the need to adjust hemoglobin concentrations in populations of African extraction. Hemoglobin concentrations are standardly adjusted for altitude and smoking and WHO also recommends that the cutoff for populations of African extraction be adjusted downward by 1 g/dL irrespective of age.[14]

Endnotes

1 World Health Report 2002. World Bank. <http://www.who.int/whr/2002/en/> (2002).

2 Stoltzfus, R. J., L. Mullany, and R. E. Black. *Iron deficiency anemia*. Comparative quantification of health risks: The global burden of disease due to 25 selected major risk factors. Cambridge: Harvard University Press (In Press).

3 A WHO/INACG group reviewed the strength of the evidence linking iron deficiency or anemia to health and development outcomes in May 2000. The proceedings of this meeting were published in the *Journal of Nutrition Supplement*, February 2001, Volume 131, No. 2S-II, and are available online at www.nutrition.org.

4 Galloway, R. 2003. *Anemia Prevention and Control: What Works, Part I-Program Guidance*. Population, Health and Nutrition Information Project. Washington, DC, 2003.

5 Prescribed compound which provides the micronutrients.

6 The degree to which a drug or other substance becomes available to the body or target tissue after it is ingested.

7 Material in this section cites information presented by Andrew Hall et al., "Public health measures to control helminth infections," in Ramakrishnan U., Ed. Nutritional Anemias, CRC Press, (New York, 2001), 215-239.

8 "Report of the Informal Consultation on the Use of Praziquantel during Pregnancy/Lactation and Albendazole/Mebendazole in Children less than 24 Months." World Health Organization. Geneva (Document WHO/CPE/PVC 2002/4).

9 A compound that kills or expels parasitic intestinal worms (helminthes).

10 "Report of the WHO Informal Consultation on Hookworm Infection and Anemia in Girls and Women." World Health Organization. Geneva (Document WHO/CTD/SIP/ 96.1).

11 An infestation with or a resulting infection caused by a parasite of the genus Schistosoma; it is common in the tropics and Far East; symptoms depend on the part of the body infected.

12 "Report of the Informal Consultation on the Use of Praziquantel during Pregnancy/Lactation and Albendazole/Mebendazole in Children less than 24 Months." World Health Organization. Geneva (Document WHO/CPE/PVC 2002/4).

13 Hyde et al., "The role of communication in comprehensive anemia control: a framework for planning and implementing a strategic communication plan," INACG, http://inacg.ilsi.org/publications.

14 Described in INACG brief "Adjusting hemoglobin values in program surveys," available at http://inacg.ilsi.org/publications.

The USAID Micronutrient Program

1820 North Fort Myer Drive
Suite 600
Arlington, VA 22209 USA
Telephone 703.807.0236
Fax 703.807.0278
e-mail: MOST@istiinc.com
www.mostproject.org